VOLUME V NUMBER 6

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A WEST AMERICAN JOURNAL OF BOTANY

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Published at North Queen Street and McGovern Avenue, Lancaster,
Pennsylvania

April, 1940

MADROÑO

A WEST AMERICAN JOURNAL OF BOTANY

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Entered as second-class matter October 1, 1935, at the post office at Lancaster, Pa., under the act of March 3, 1879.

Established 1916. Published quarterly. Subscription Price $2.50 per year. Volume I, Numbers 1 to 17, complete, $5.00. Volume II, Numbers 1 to 17, complete, $5.00. Volume III, Numbers 1 to 8, complete, $5.00. Single numbers $0.75.

Papers up to 15 or 20 pages are acceptable. Longer contributions may be accepted if the excess costs of printing and illustration are borne by the contributor. Range extensions and similar notes will be published in condensed form with a suitable title under the general heading "Notes and News." Articles may be submitted to any member of the editorial board. Manuscripts may be included in the forthcoming issue provided that the contributor pay the cost of the pages added to the issue to accommodate his article. Reprints of any article are furnished at a cost of 4 pages, 50 copies $3.70; 100 copies $4.10; additional 100's .75¢; 8 pages, 50 copies $5.40; 100 copies $6.00, additional 100's $1.20. Covers, 50 for $2.50; additional covers at $1.50 per hundred. Reprints should be ordered when page proofs are returned.

Published at North Queen Street and McGovern Avenue, Lancaster,
Pennsylvania, for the

CALIFORNIA BOTANICAL SOCIETY, INC.

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Annual membership dues of the California Botanincal Society are $2.50, $2.00 of which is for a year's subscription to Madroño. Dues should be remitted to the Treasurer. General correspondence and applications for membership should be addressed to the Secretary.

SOME ABNORMAL INFLORESCENCES

A. M. Johnson

Ceratonia Siliqua L.

The carob or St. John's bread, *Ceratonia Siliqua* L., is a common ornamental in southern California. It is indigenous to the Mediterranean region, where it may grow to a height of fifty feet. Normally, the flowers are polygamo-dioecious and are borne in racemes. Petals are wanting. At the base of the gynoecium is a prominent gland (pl. 15, B, *gl*). The carpels, as they grow to maturity, become more or less strongly curved.

The abnormal inflorescences here to be described were found in November, 1934, by my colleague, Dr. Carl Epling, who kindly turned them over to me for study. There were nine inflorescences, all of them carpellate. One of the peculiar features of these inflorescences (except one) was that the gynoecium of the terminal (uppermost) flower consisted of more than one carpel—the number of carpels ranging from two to four. A four-carpellate gynoecium was present in two instances; in five instances the gynoecium was three-carpellate, and in one instance, two-carpellate (pl. 15, A, B).

The remaining inflorescence differed markedly from those above mentioned in that the gynoecium of the terminal flower was replaced by an elongate axis bearing sixteen carpels, the four lowest of which formed a basal whorl, while the other twelve were spirally arranged along the axis (pl. 15, E). The four basal carpels were adnate by their stipes (gynophores) to this (central) axis. Between the four terminal carpels there were two minute rudimentary ones (pl. 15, F). Although these carpel rudiments appear to be apical in relation to the axis, it is probably correct to assume that they are morphologically lateral, as are the other carpels on the axis.

In outward appearance this carpel-bearing axis bore a marked resemblance to a normal inflorescence. However, none of the twelve spirally arranged carpels showed any indication of arising from an individual stipe—that is, they were all sessile. The only indication of such a stipe was below the basal whorl of four carpels. Nor was there any indication of the presence of the gland so characteristic of normal flowers. These distinctions will be seen clearly in the accompanying figures. Aside from these details and the fact that these carpels were smaller and that some of them were not completely closed (pl. 15, G, H, J) they had the appearance of normal carpels.

The illustrations (pl. 15, B, C, D, G, I, J) show that the common stipe varied somewhat in length: in figures C, D, and G it is relatively long; in B, I, and J it is shorter. Thus the situation

Madroño, vol. 5, pp. 177–208. May 3, 1940.

under discussion (pl. 15, E) may be regarded as an exaggerated state of figure G, for example—indeed, the presence of the rudimentary carpels at the summit of G suggests that had the development proceeded further there might have resulted a state comparable to that at E. The same argument applies to the other similar cases illustrated (pl. 15, I, J).

It seems obvious, therefore, that we have here not a proliferation, so to say, of the primary inflorescence, but rather a pluricarpellate (pleiomerous) condition of the gynoecium of the terminal (but not morphologically apical) flower, in which the common stipe or gynophore of the several carpels has developed as an elongate axis, making the whole appear as though it were a secondary inflorescence.

Rudimentary "apical" carpels were found in a few instances, but not all on the same inflorescence. Two of these instances are figured (pl. 15, G, H, J). For comparison with the abnormal states the terminal portion of a normal inflorescence is figured (pl. 15, K). Here the carpels of three normal flowers are shown. The difference between this state and that of the abnormal ones is striking.

QUERCUS AGRIFOLIA NEÉ

The inflorescences of the coast live oak, *Quercus agrifolia* Neé, were borne on the lower portion of a shoot of the season (pl. 16, A, *a*, *b*, *c*). There were three inflorescences, the lowest, and shortest (*a*), consisted of nine flowers, of which the second and the two terminal ones had been broken off; the second and longest inflorescence (*b*) bore eleven flowers; the third and next longest (*c*) bore nine flowers. In all three inflorescences, as will be seen from the figures, the flowers were grouped in pairs, the pairs more or less closely approximate along the upper portion of the inflorescence, while the few lower flowers were solitary and more or less remote.

The morphological nature of the flowers of the three inflorescences is schematically represented in text figure 1. As will be

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EXPLANATION OF THE FIGURES. PLATE 15.

PLATE 15. CERATONIA SILIQUA: APICAL PORTION OF SIX INFLORESCENCES. A, terminal gynoecium of 2 distinct carpels arising from same stipe (gynophore), *gl*, gland. B, terminal carpels of A enlarged. C, terminal 3-carpellate gynoecium. D, terminal carpels of C enlarged; carpel *a* separate from carpels *b* and *c* except at base of common stipe. E, gynoecium of terminal flower replaced by elongated axis bearing 16 carpels, the 4 lowest whorled, 12 above spirally arranged. F, apical carpels of E with 2 rudimentary carpels between them. G, terminal 4-carpellate gynoecium arising from a common stipe: *c*, calyx, *br*, minute bracts, *x*, smallest carpel, open at base exposing an ovule. H, carpel *x* of G; *ov*, exposed ovule, *n*, rudimentary carpels. I, terminal gynoecium of 3 carpels arising from a common stipe. J, opposite side of terminal gynoecium of I showing smallest carpel open at base exposing an ovule and 2 rudimentary carpels in front of ovule. K, normal inflorescence showing 3 normal carpels developed from 3 flowers.

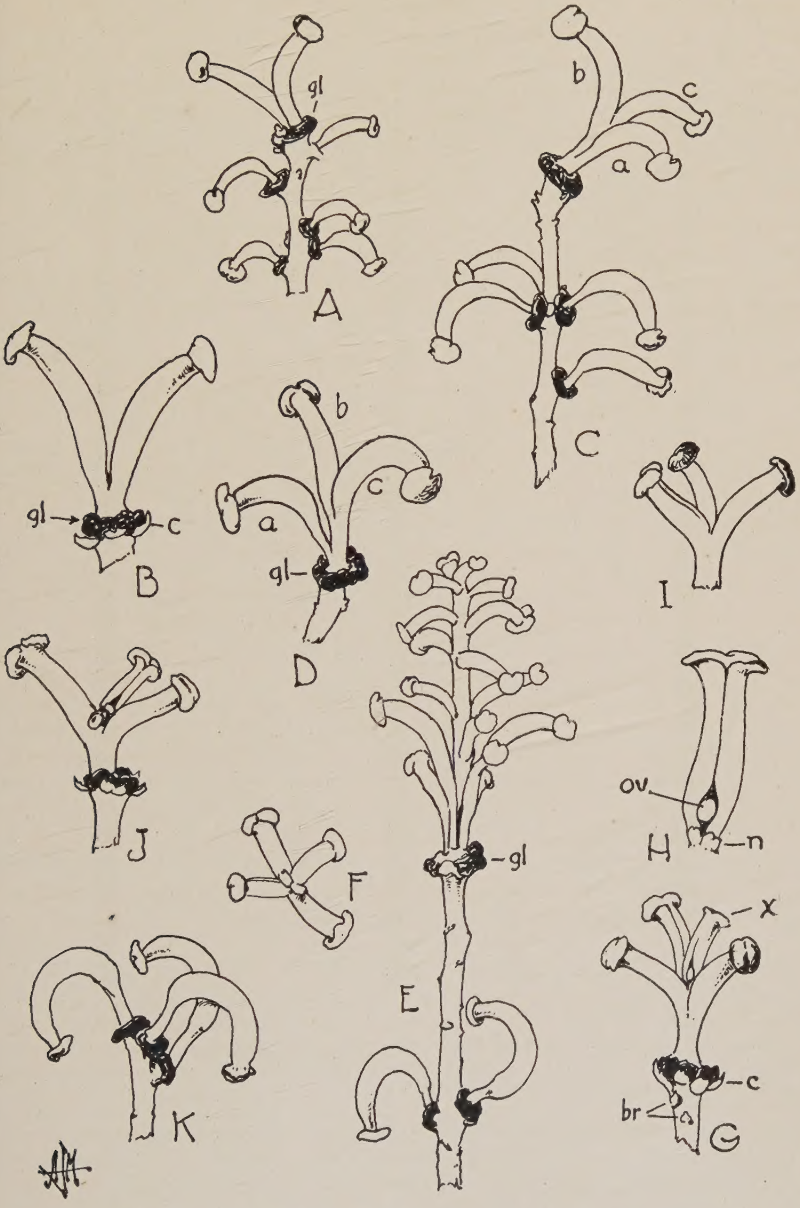

Plate 15. Ceratonia Siliqua: apical portion of six inflorescences.

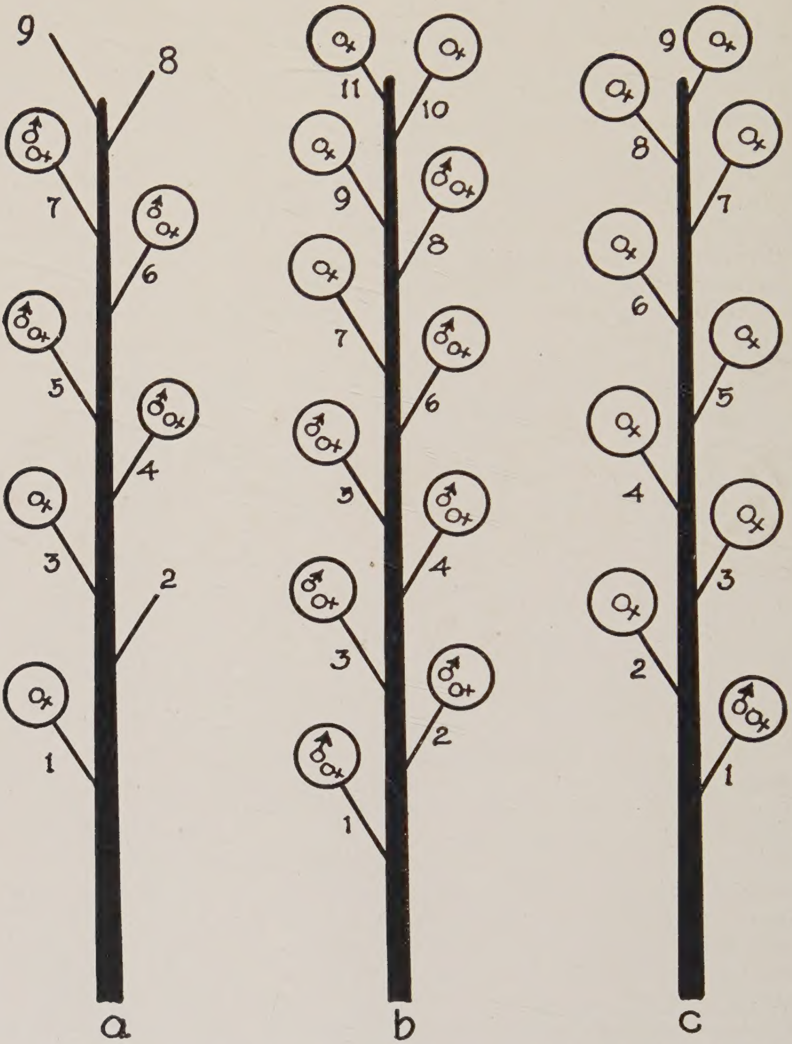

Fig. 1. *Quercus agrifolia* Neé. Diagrammatic representation of inflorescences *a, b, c* (pl. 15, A). Carpellate and bisexual flowers are designated by conventional symbols.

seen from the first diagram (*a*) two of the lower flowers (1, 3) were carpellate, while the four next above (4, 5, 6, 7) were bisexual; the missing flowers are represented by the numerals 2, 8, and 9. In the next and longest inflorescence (*b*) all but four of the eleven flowers were bisexual, the four exceptions (7, 9, 10, 11) being carpellate. In the third inflorescence (*c*) only a single flower, the lowermost of the nine, was bisexual, all the others being carpellate.

In text figure 2 are shown the floral diagrams of the seven bisexual flowers (1, 2, 3, 4, 5, 6, 8) of inflorescence *b*. These empirical diagrams show the orientation of the styles (shaded black) in relation to the stamens and the perianth segments. In these as in all the other flowers examined (pl. 16) it will be seen that there is a marked variation in the number of stamens and of styles present. Certain modifications of the individual organs will also be noted. The number of normal styles ranged from two to four. In flower 3 (text fig. 2) one of the stamens (shown at the left in the diagram) was a mere rudiment; in flowers 4 and 6 one of the styles was staminodial along one side, and each bore an anther; in flower 8 only a single stamen was present, along with four styles; in one of the two stamens in flower 5 one of the anther sacs was rudimentary.

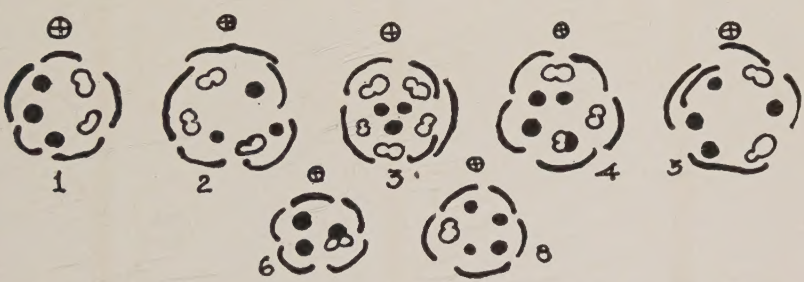

FIG. 2. *Quercus agrifolia* Neé. Empirical diagrams of flowers 1, 2, 3, 4, 5, 6, 8, inflorescence *b*.

Some rather pronounced variations and modifications were found in the flowers of inflorescence *a*. The floral diagrams (styles shaded black) of five of these flowers are figured (pl. 16, J, K, L, M). As in flowers 4 and 6 of inflorescence *b* we find here also, in the lowermost flower, a half-staminodial style bearing an anther on the modified side (pl. 16, J). This anther-bearing style and two of the other styles present differed from the normal fourth style in being very slender, yet of the same length as the normal style. Besides these peculiarities there was present, closely approximate to the base of the anther-bearing style, a minute rudimentary organ which, from its appearance, could be interpreted as a fifth style (pl. 16, E, *x*). The anther sacs of the adjacent staminodial styles were of unequal size, elongate, and pointed at the ends (pl. 16, F). In the fourth flower of this inflorescence (*a*) four normal stamens were present, along with three dissimilar styles—one normal, the other two very slender and with somewhat abnormal stigmas (pl. 16, G, K); the stamens were all normal. In the fifth flower there were five normal stamens and three abnormal styles which were more or less coalescent basally. The sixth flower showed one normal stamen, one stamen with a normal anther but with a short modified filament which was coalescent basally with the base of the adjacent style, and besides these a smaller stamen with an abnormal anther, and one rudimentary stamen (*r*). Two of the three styles in this flower were very stout and strongly bent at the middle, the larger of the two otherwise having a normal appearance; the third style was minute and abnormal. All three styles were coalescent at the base (pl. 16, I, M). Stout styles of the geniculate shape just mentioned were found in a few other flowers as well. In the seventh flower there were two normal stamens and three apparently normal styles which were coalescent at the base (pl. 16, N).

In inflorescence *c* the lowermost flower (1) appeared to be normal in every respect. This was the only flower of the entire lot from the three inflorescences which did not show any detectable abnormality in the organs present.

A strongly geniculate condition was found in the three styles of the third flower on inflorescence *b*, except that in this case the styles were more slender and, as far as could be discerned, all were normal (pl. 16, C, D).

As will be seen from the floral diagrams in plate 16 and in text figure 2, the orientation of the floral organs in relation to the median and the transverse planes of the flowers is very erratic. In the normal flower (1) of inflorescence *c* (pl. 16, B) three stamens are situated anteriorly, the middle one of which lies in the median plane opposite a posterior median style. The reverse of this situation is seen in the fourth flower of inflorescence *a*: two of the three styles lie posteriorly in a transverse plane, while the third style lies anteriorly in the median plane (pl. 16, K). A similar situation obtains in flower 3 of inflorescence *b* (text fig. 2). A fairly evenly whorled arrangement of the stamens and styles was found in a number of instances (pl. 16, J; text fig. 2, flowers 1, 2, 5, 8). As regards the ovaries these appeared to be as well developed as in normal carpellate flowers (pl. 16, B, C. D, E).

In retrospect it will be noted that in the three inflorescences the majority of the flowers (present) of inflorescence *a* were bisexual, or in the ratio of four to two; in inflorescence *b* the ratio was seven to four; in *c* it was one to eight. In other words the total number of bisexual flowers in proportion to unisexual (carpellate) flowers was twelve to thirteen—that is, a nearly equal distribution. No staminate flowers were found. In only one flower (bisexual) were the organs present normal in every respect. Three flowers had modified (staminodial) styles bearing

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Explanation of the Figures. Plate 16 (*continued from page 183*).

I, flower 6, anterior view, showing two strongly geniculate styles and a third rudimentary style immediately to the left; *p*, perianth; *t*, stamens; *r*, rudimentary stamen. J–N, empirical diagrams of flowers in inflorescence *a* (in L, M and N coalescence of styles is indicated by black lines): J, flower 1 (see also E). K, flower 4. L, flower 5. M, flower 6, styles coalesced with a stamen (see also I). N, flower 7.

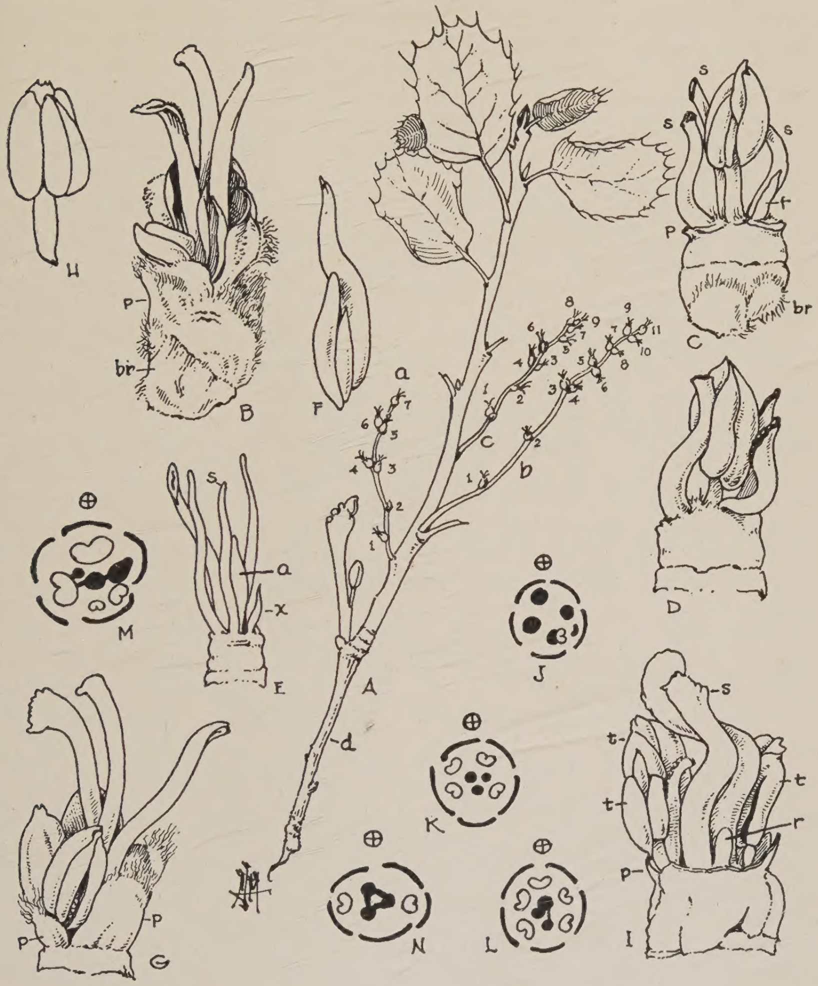

Plate 16. Abnormal inflorescences of Quercus agrifolia Neé. A, shoot: *a, b, c,* abnormal inflorescences; *d,* growth of previous season. B, flower 1, inflorescence *c*: showing three styles and five stamens (three in full view); *br,* basal bract folded back; *p,* perianth. C, flower 3, inflorescence *b,* adaxial side with perianth removed: *br,* minute bracts; *p,* base of the removed perianth; *s,* styles; *f,* filament of a second stamen—at its left a stamen with one anther-sac abnormal. D, flower 3, inflorescence *b,* showing strongly geniculate styles. E–I, detail of flowers from inflorescence *a*: E, flower 1, normal style (at left); two filamentous abnormal styles; *s,* filamentous abnormal staminodial style bearing abnormal anther *a* on one side; *x,* rudimentary style. F, dorsal aspect of the anther-bearing style in E, showing the abnormal and unequal anther sacs. G, flower 4, anterior view, showing three dissimilar styles and three of the four stamens; *p,* perianth. H, one of stamens shown in G. (*Continued on page 182.*)

an anther on the staminodial side. The stamens present ranged in number from one to five and the styles from two to four. In no case were the perianth segments modified in any way.

Department of Botany,
University of California at Los Angeles,
March, 1937.

CYTOPHYLETIC ANALYSIS OF CERTAIN ANNUAL AND BIENNIAL CRASSULACEAE

J. T. Baldwin, Jr.

An attempt is here made to analyze from a cytophyletic viewpoint the relationship existent among several annual and biennial Crassulaceae, a family predominantly perennial. Such an analysis necessarily passes from fact to hypothesis, but the analysis should be made. Observations isolated have restricted meaning; from them integrated, hypotheses may be formulated and, with the accumulation of evidence, may be re-examined and tested.

The systematic history of certain of the species considered is a record of many taxonomic maneuvers. That history is reviewed. Each different taxonomic concept of a plant should be indicative of that plant's affinities. The plants treated here will doubtless be subjected to other changes in nomenclature. And that is as it should be. "There is no finality in taxonomy" (L. H. Bailey).

Sedum pusillum Michx.

Michaux (20, 1803) described as *Sedum pusillum,* a small, octandrous, white-flowered plant from Flat-rock, North Carolina. Pursh (22, 1814), apparently confusing Michaux's species with the plant later designated *S. Nevii* Gray, reported *S. pusillum* to be perennial and to occur in Virginia "on the east banks of the Shanadoah River." Nuttall (21, pp. 110, 293, 1818) included *S. pusillum* as a synonym of his *Tillaea ? cymosa* and (21, p. 293) made both *Tillaea ? cymosa* and *Sedum pusillum* synonymous with *Diamorpha pusilla.* Gray (17, 1876) first recognized that Nuttall and subsequent writers had confounded two species and that *Sedum pusillum* and *Diamorpha pusilla* are distinct. Gray, in 1875, found them both in great abundance on Stone Mountain in Georgia; Canby had collected the two there in 1869 but had not differentiated between them. Rose (24, 1905) established for Michaux's species the monotypic genus *Tetrorum;* Berger (6, 1930) and Fröderström (16, 1935) again referred the plant to *Sedum.* The species is known only from North Carolina and Georgia. As treated by Fröderström, the species has narrowly spurred leaves, 4- to 5-parted flowers with white or purple petals broad at the base, immature carpels suberect and broad-styled, mature carpels horizontally spreading, tillaeoid, and very short-styled, and ovoid seed.

Plants of *Sedum pusillum* were grown at Charlottesville, Virginia, and at Ithaca, New York, from seed collected on Stone Mountain by Dr. Edgar T. Wherry. (The identity of each species investigated during the present study was checked by Dr. R. T. Clausen of the Bailey Hortorium.) The chromosomes were studied in smears of roots, leaves and anthers. The somatic smear method has been discussed by the present author (4, 1938). The $2n$-number of the species is 8 (pl. 17, fig. 1), and the n-number is 4 (pl. 17, fig. 2, second metaphase; fig. 3, second anaphase). Each chromosome has a median or submedian constriction. The four pairs of chromosomes are distinguishable at somatic metaphase (pl. 17, fig. 1).

SEDUM STELLATUM L.

Sedum stellatum, described by Linnaeus, is an annual of the Mediterranean region. Fröderström (15, 1932) characterized the species as having shortly petiolate leaves with obovate-orbiculate blades, 4- to 5-parted, purplish-red flowers with petals "free to the base" and with "mature carpels stellate, connate 1.5–2 mm., with a long and narrow gibbosity," and ovoid seed. Two lines of *S. stellatum,* B325 and C142, in cultivation at Cornell University have been examined cytologically. The species has a $2n$-number of 10 (pl. 17, fig. 4) and an n-number of 5 (pl. 17, fig.5, first metaphase; fig. 6, first anaphase; fig. 7, second anaphase). The five pairs of chromosomes are distinguishable at somatic metaphase (pl. 17, fig. 4).

SEDUM NUTTALLIANUM RAF.

Rafinesque, in 1832, established *Sedum Nuttallianum* for an annual plant distributed from Missouri and Arkansas to Texas. The species, as treated by Fröderström (16, 1935), has broadly spurred, oblong leaves, 5-parted, yellow, sessile flowers with "petals united with their broad bases" and with "carpels united 1 mm., gibbous and stellate," and ovoid, mammillate seed. Plants of *S. Nuttallianum* were collected near Georgetown, Texas, by Dr. Gordon B. Wolcott. The writer found those plants to have a $2n$-number of 20 (pl. 17, fig. 8), an n-number of 10 (pl. 17, fig. 9, first metaphase).

SEDUM ANNUUM L.

Linnaeus described *Sedum annuum.* Berger (6, 1930) placed the species systematically adjacent to *S. Nuttallianum. Sedum annuum* is annual or, sometimes, by means of small, sterile shoots, perennial (Fröderström, 15, 1932); at Ithaca, New York, the species is seemingly perennial. It is distributed from "Caucasus through Asia Minor, Russia and Europe to Greenland." The plant has bluntly spurred, "linear-oblong to obovate" leaves, 5-parted, yellow to greenish-yellow, sessile flowers, "carpels stellate in fruit, connate 0.7–1 mm.," and ovoid seed. Böcher (7, 8, 1938) reported an *n*-number of 11 for *S. annuum* as represented in Greenland. Three lines of the species have been investigated during the present study: V122 at The Blandy Experimental Farm, C105 and W221 at Cornell University. A somatic number of 22 chromosomes (pl. 17, fig. 10) and a gametic number of 11 (pl. 17, fig. 11, first metaphase; fig. 12, second metaphase) were determined.

DIAMORPHA NUTT.

Nuttall (21, 1818) founded *Diamorpha,* the name meaning "deformed or contrary formed":—"in the structure of the capsule it entirely differs from every other plant in the Natural Order Sempervivae." (The Crassulaceae were established in their true limits in 1789 by A. L. de Jussieu under the name Sempervivae, a name assigned by Linnaeus and Bernard de Jussieu to a more comprehensive group including the present Crassulaceae and several other families; the name Crassulaceae was given the family in 1805 by A. P. De Candolle.) De Candolle (11, 1828) placed *Diamorpha,* with *Penthorum* L., in the tribe Crassulaceae Anomalae. Torrey and Gray (28, 1840) made the tribe Diamorpheae for these two genera and gave the following description of *D. pusilla:* "Carpels 4, united below the middle, tapering into short styles, when old divergent above, not dehiscent by either suture, but by the vertical separation of the dorsal portion (nearly half) of each carpel in a valvular manner . . . its remarkable dehiscence so analogous to that of *Penthorum.*"

In distinguishing *D. pusilla* from *Sedum pusillum,* Gray (17, 1876) wrote: "The *Diamorpha,* of barely half the size, and with proportionally wider leaves, has a dull purplish hue, extending more or less to the flowers; the sepals are distinct nearly to the base and narrower; the petals oval and obtuse; the ovaries and pods tapering from a broader base into a subulate style; the seeds round-oval; and the cruciform union of the pods at base and their peculiar dorsal valvular dehiscence, peculiar to the genus . . ."

Britton (10, 1905) made the combination *Diamorpha cymosa* (Nutt.), thus rendering *D. pusilla* synonymous; he designated as *D. Smallii* a plant of localized distribution in North Carolina. Fröderström (16, 1935) made the combinations *Sedum cymosum* (Nutt.) Fröd. var. *Smallii* (Britt.). The generic status of *Diamorpha* is recognized here. The genus occurs from North Carolina and Tennessee to Georgia and Alabama.

Cytological study has been made of *Diamorpha cymosa* (Nutt.) Britt., from Stone Mountain in Georgia (seed collected by Dr. Edgar T. Wherry), from Eight-Acre Rock, Bibb County, Alabama (seed and plants collected by Dr. A. V. Beatty), and from

Rocky Face Mountain, west of Statesville, North Carolina (plants collected by Dr. C. E. Raynal and sent to the writer by Dr. W. C. Coker). The species has a 2*n*-number of 18 (pl. 17, fig. 13) and an *n*-number of 9 (pl. 17, fig. 14, first metaphase; fig. 15, second metaphase).

SEDELLA BRITT. AND ROSE

The genus *Sedella,* originally characterized by having flowers with yellow petals united at the base, ten stamens, one-seeded, oblong carpels, and erect seed, was established by Britton and Rose (9, 1903) for two Californian annuals first described as species of *Sedum: Sedum pumilum* Bentham (5, 1849) and *Sedum Congdoni* Eastwood (12, 1898). Jepson (18, 1925) made the combination *Sedella pumila* (Benth.) Britt. and Rose var. *Congdoni* (Eastw.). Berger (6, 1930) restored these plants to *Sedum* as two species of section *Sedella.* Fröderström (16, 1935) made the combination *Sedum pumilum* Benth. var. *Congdoni* (Eastw.); he considered this to be the only species of the group *Sedella.* Sharsmith (26, 1936) resurrected the genus *Sedella* and published a third species, a Californian annual, *S. pentandra.* That writer has now described a second pentandrous species (27).

At the request of Mrs. Sharsmith, Dr. Herbert L. Mason, of the University of California Herbarium, sent the writer, on January 18, 1938, seeds from the following herbarium specimens: *Sedella pentandra,* Sulphur Creek, San Antonio Valley, Mount Hamilton Range, Santa Clara County, California, June 8, 1935, *H. K. Sharsmith 3271; Sedella pumila,* Napa, Napa County, California, May 31, 1935, *H. L. Mason; Sedella Congdoni,* Porterville, Tulare County, California, May 13, 1935, *W. B. Richardson.* By the end of May, 1938, plants from those seeds were in flower in the greenhouses of Cornell University. A 2*n*-number of 18 for each of the species—*S. pentandra* (pl. 17, fig. 16), *S. Congdoni* (pl. 17, fig. 17), and *S. pumila* (pl. 17, fig. 18)—and an *n*-number of 9 for two of them—*S. Congdoni* (pl. 17, fig. 19, first metaphase) and *S. pumila* (pl. 17, fig. 20, second metaphase)—were determined. Each chromosome was observed at somatic metaphase to have a median to submedian constriction. Chromosome number and morphology, therefore, seem not to be differential characters for these species.

DISCUSSION

The plants treated in this paper are representatives of subfamily Sedoideae and, with the exception of the *Sedella* species, have at some time been placed in close taxonomic association. *Sedella* and *Diamorpha* may be expressions of parallel tendencies in the evolution of the Crassulaceae. Both genera are non-perennial. Both afford evidence of an intimate relationship with members of subfamily Crassuloideae: some species of *Sedella* are pentandrous, and the chief distinguishing character of the Crassuloideae is the presence of only a single whorl of stamens (Berger, 6, 1930); the carpels in *Diamorpha* (as in *Sedum pusillum*) are tillaeoid (Fröderström, 16, 1935), and *Tillaea* is an annual complex of the Crassuloideae. Moreover, *Sedella* and *Diamorpha* have a gametic number of 9, and this number is rare among those determined for the family; the other cases known for the family proper are a species of *Rosularia* Stapf and one of *Cotyledon* L., these being the only chromosomally studied members of the two genera. In the "Index Kewensis," *Rosularia* is reduced to *Umbilicus* DC., which in turn is largely included in *Cotyledon;* Berger (6, 1930) referred the first of these genera to the Sedoideae, the other two to the Cotyledonoideae. Then there is *Penthorum sedoides* L. Rocén (23, 1928) reported the n-number of Asiatic and American plants of this species to be 8; the present writer, working with the species in Virginia, found a $2n$-number of 18, n-number of 9. Since the gametic number of 9, unusual for the family, occurs in *Penthorum* and *Diamorpha,* it is perhaps phyletically significant that, as mentioned above, De Candolle (11, 1828) and Torrey and Gray (28, 1840) placed these genera together as being peculiar. By other workers, *Penthorum,* variously conceived to include from one to three species, has been referred to the Crassulaceae (Schönland, 25, 1891), to the Saxifragaceae (Baillon, 2, 1872; Engler, 13, 1930), and to a family of its own, the Penthoraceae (van Tieghem, 29, 1899). Embryological studies indicate that the genus belongs in the Saxifragaceae but shows kinship with the Crassulaceae (Mauritzon, 19, 1933). Evidence given in the present instance would seem to favor the placement of the genus in the latter family. But the entire discussion well illustrates that affinities among plants are both linear and interlinear, evolutionary trends being sometimes confluent, and that taxonomic categories are discrete with respect to certain characters, continuous with respect to others.

Sedum pusillum has a somatic chromosome number of 8, a gametic number of 4. These numbers are the lowest known for the Crassulaceae and are to be contrasted with a $2n$-number of *ca.* 500, in a species of *Kalanchöe* L. (Baldwin, 4, 1938), as the highest. *S. pusillum* has tillaeoid carpels (Fröderström, 16, 1935),

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Explanation of the Figures, Plate 17.

Plate 17. Chromosomes of Certain Crassulaceae. Figs. 1–3, *Sedum pusillum,* $2n = 8$, $n = 4$: fig. 1, somatic metaphase; fig. 2, second metaphase; fig. 3, second anaphase. Figs. 4–7, *Sedum stellatum,* $2n = 10$, $n = 5$: fig. 4, somatic metaphase; fig. 5, first metaphase; fig. 6, first anaphase; fig. 7, second anaphase. Figs. 8–9, *Sedum Nuttallianum,* $2n = 20$, $n = 10$: fig. 8, somatic metaphase; fig. 9, first metaphase. Figs. 10–12, *Sedum annuum,* $2n = 22$, $n = 11$: fig. 10, somatic metaphase; fig. 11, first metaphase; fig. 12, second metaphase. Figs. 13–15, *Diamorpha cymosa,* $2n = 18$, $n = 9$: fig. 13, somatic metaphase; fig. 14, first metaphase; fig. 15, second metaphase. Figs. 16–20, *Sedella,* $2n = 18$, $n = 9$: fig. 16, *S. pentandra,* somatic metaphase; fig. 17, *S. Congdoni,* somatic metaphase; fig. 18, *S. pumila,* somatic metaphase; fig. 19, *S. Congdoni,* first metaphase; fig. 20, *S. pumila,* second metaphase. Magnification: fig. 11 drawn × 4900, the other figures, × 3700, and reduced about three-fifths in reproduction.

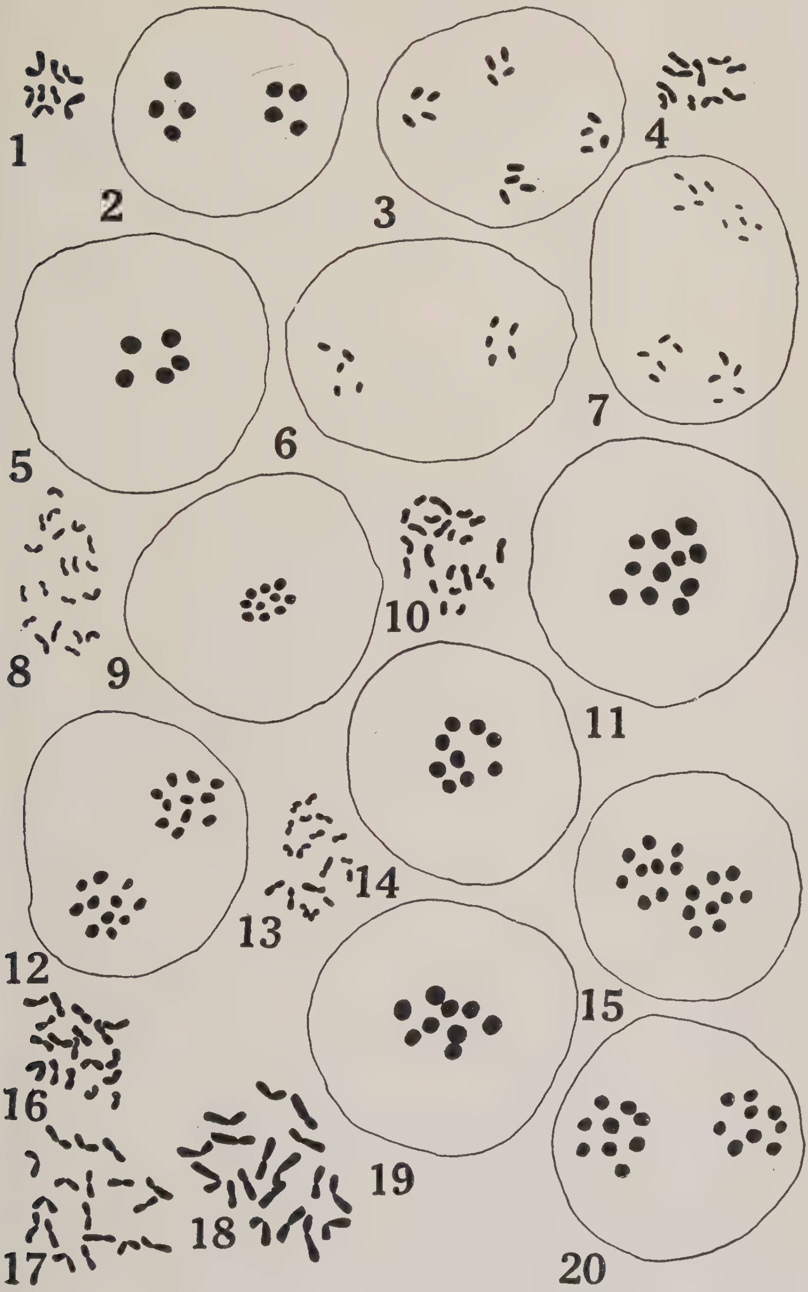

Plate 17. Chromosomes of certain Crassulaceae.

and the *Tillaea*-complex is considered to be primitive (Fröderström, 14, 1930; Berger, 6, 1930). The members of that complex cytologically investigated have somatic numbers of 16 (Baldwin, 3, 1936). It is logical, therefore, to consider that 4 is the initial or one of the initial chromosome numbers of the family.

Sedum stellatum has an *n*-number of 5. This species is usually associated with the *Sedum hispanicum*-complex of the genus, and some representatives of that complex have *n*-numbers of 15 and 20 (Baldwin, ms.). Fröderström (16, 1935) suggested that *S. stellatum* be compared with his group consisting of *S. pusillum*, *S. Nuttallianum*, and *S. cymosum* (*Diamorpha cymosa*): *S. Nuttallianum* has an *n*-number of 10. Thus, there exists in *Sedum* a 5-chromosome system, and this, like the 4-chromosome system, has at the lower extreme of its polyploid series non-perennial species. It is likely that one of these systems deviated from the other. So, also, it is reasonable that the *Diamorpha* and *Sedella* aggregates, with an *n*-number of 9, are the amphidiploid results of fusions between representatives of the 4- and 5-chromosome tendencies. This possibility is an additional basis for the treatment of *Diamorpha* and *Sedella* as entities of generic rank. Further, we may consider that the farther, temporally and physically, the primitive developmental streams got from their locus of bifurcation, the more dissimilar, in general, they became. And similarly: the more different was the result of each successive intermingling of those streams. If the products of such unions then underwent a doubling of chromosomes—became amphidiploid, the immediate origin of "categories higher than a species" might be expected (Anderson 1, 1937). It is interesting, therefore, that: *Sedella* and *Diamorpha* are often regarded as genera of questionable standing; *Rosularia* is placed at the periphery of the Sedoideae; *Cotyledon* is the type of another subfamily; *Penthorum* is a genus of uncertain familial affinities, and all these groups, apparently constituting an evolutionary series of greater and greater morphologic diversity, have an *n*-number rare among those known for the Crassulaceae. Incidentally, the series supports the view that in this family life-duration was primitively non-perennial.

SUMMARY

Cytotaxonomic data show that certain annual and biennial Crassulaceae may be referred, theoretically, to primitive 4- and 5-chromosome systems and to an amphidiploid system originating from these: *Sedum pusillum* has 8 somatic, 4 gametic chromosomes; *S. stellatum*, 10 and 5 respectively; *S. Nuttallianum*, 20 and 10; *Diamorpha cymosa*, 18 and 9; *Sedella pentandra*, *S. Congdoni*, and *S. pumila*, 18 and 9. *Sedum annuum*, behaving sometimes as a perennial, has 22 somatic, 11 gametic chromosomes; this species has, on occasion, been placed systematically close to *S. Nut-*

tallianum. The $2n$-number, 8, in *S. pusillum* is the lowest known for the family and contrasts with *ca.* 500 in a species of *Kalanchöe.*

Diamorpha and *Sedella* are considered here to be "good" genera: their chromosome number appears to be unusual for the family, and that number is inferred to be the doubled product of the fusion between representatives of two different evolutionary streams. These genera and other Crassulaceae (a species each of *Rosularia, Cotyledon,* and *Penthorum*) with a known n-number of 9 apparently form a series of greater and greater morphologic diversity. Chromosome number and morphology seem not to be differential among *Sedella* species.

Seemingly in the Crassulaceae the trend in life-duration has been from the annual or biennial to the perennial condition. Relationships in this family are linear as well as interlinear, developmental streams having been sometimes confluent, and the taxonomic categories of the family are sharply delimited with respect to certain characters, continuous with respect to others.

ACKNOWLEDGMENT

The writer thanks those various individuals who have contributed, in one way or another, to this study and expresses appreciation for the privilege of working, as a Research Fellow, at The Blandy Experimental Farm and, as a Fellow of the General Education Board, at the Bailey Hortorium and in the Department of Botany of Cornell University.

College of William and Mary,
Williamsburg, Virginia,
November 15, 1938.

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FURTHER NOTES ON THE GENUS SEDELLA

Helen K. Sharsmith

A New Species of Sedella

In May, 1936, shortly after publication of "The Genus *Sedella*" (Madroño 3: 240–248. 1936), a *Sedella* collected by Milo S. Baker in Lake County, California, was received for examination. Its five stamens indicated an affinity with *Sedella pentandra* of the Mount Hamilton Range, although differences were obvious. The material was too mature and too scant, however, for complete study. Mr. Baker recently re-collected this *Sedella* at the same locality, and sent fresh plants from which full diagnosis was possible. On the basis of these two collections, a fourth species is described below for the genus *Sedella*:

Sedella leiocarpa sp. nov. Herba annua erecta glabra succulenta, 3–5 cm. alta; caulis validus simplex vel ramosus, ramis e nodis inferioribus oppositis uni- vel bijugatis, quam caule primario brevioribus; cymae terminales subracemosae, simplices vel ramosae; flores conferti secundi biseriales subsessiles, 3.5–4.0 mm. longi, 3–4 mm. lati; hypanthium brevicampanulatum; petala ad basim connata, flavida dorsaliter medio rubrovittata lanceolata acuminata, 3–3.5 mm. longa, per anthesin patentia, post anthesin erecta, fructu paullo patentia; nectaria epipetala rubrescentia complanata, 0.5–0.8 mm. longa, apice lato truncato emarginatove; stamina 5 epipetala; carpella 1.5–2.0 mm. longa, glabra laevigata; stylus erectus 0.3–0.4 mm. longus; folliculi paullo patentes laevigati rubescentes, 2.0–3.0 mm. longi; semina solitaria.

Erect or spreading, glabrous, succulent, reddish annual 3–5 cm. tall; root system spreading, fibrous, 0.5–1.5 cm. in diameter; hypocotyl 1–1.5 cm. long; stem stout, simple or with one or two pairs of spreading branches in lower nodes, these usually shorter than main stem; cauline leaves sessile, entire, very fleshy, oblong-ovoid, obtuse, 4–5 or more mm. long, 3 mm. wide, gibbous at base, opposite below, alternate above, caducous; terminal inflorescence a bracteate, falsely racemose cyme occasionally with one to two or more branches, similar inflorescences terminating lower stem branches; bracts of the inflorescence like cauline leaves but progressively smaller and more acute toward branch tips, persistent through flowering stage; flowers crowded, secund in two rows, alternate, 3.5–4 mm. long, 3–4 mm. wide, subsessile; hypanthium shallow, campanulate; sepals 5, triangular acute, 0.5 mm. long; petals coalesced at base, pale yellow, dorsally suffused with red, lanceolate, acuminate, 3–3.5 mm. long, spreading in anthesis, erect in early fruit, appressed to spreading carpels in mature fruit; nectaries epipetalous, reddish, flattened, 0.5–0.8 mm. long, apex broadened, glandular, truncate to erose or somewhat emarginate; stamens 5, epipetalous, 1.5–2 mm. long, anthers yellow, filaments capillary; carpels 5, free, light green, erect, approximate, 1.5–2 mm. long, glabrous, smooth, style erect, 0.3–0.4 mm. long; follicles reddish, 2–3 mm. long, 1-seeded, spreading, glabrous, suture sharply keeled; seeds erect, light brown, oblong clavate, microscopically striate, 1–1.3 mm. long.

Type. Dry, rocky soil in chaparral, 6.5 miles north of Lower Lake, Lake County, California, May 3, 1938, *Milo S. Baker 8971* (Herb. Univ. Calif. no. 592627, isotypes at Calif. Acad. Sci. and Gray Herbarium), plants in flower and early fruit. Topotype. April 26, 1936, *Milo S. Baker* (Herb. Univ. Calif. no. 592628), plants in fruit.

Although the generic affinities of *Sedella leiocarpa* are readily recognized, the species is clearly separable from the other three members of the genus, particularly in its completely glabrous carpels and large, red nectaries. The five stamens and erect, short style link it closely to *S. pentandra,* but the hypanthium is campanulate as in the ten-stamened *S. pumila* and *S. Congdoni,* not turbinate as in *S. pentandra,* and the petals are almost as large as those of *S. pumila.* The growth form resembles that of *S. pentandra* and *S. pumila* with the plants even shorter than in *S. pen-*

tandra, but as stout as in *S. pumila.* A key to the five-stamened species of the genus *Sedella* is given below:

Carpels glandular papillate; petals 2 mm. long; follicles appressed	*S. pentandra.*
Carpels glabrous; petals 3–3.5 mm. long; follicles somewhat spreading	*S. leiocarpa.*

AN EXTENSION OF THE KNOWN RANGE OF SEDELLA PENTANDRA

Sedella pentandra, as first described (Madroño 3: 240. 1936), was known only from the Mount Hamilton Range of the inner South Coast Range of California. It was reported subsequently by John Thomas Howell (Leafl. West. Bot. 2: 99. 1938) from The Pinnacles, San Benito County (*J. T. Howell 12939,* Herb. Calif. Acad. Sci.; Herb. Univ. Calif.). The Pinnacles are in the Gavilan Range, the unit of the South Coast ranges which lies between the San Carlos Range and the Santa Lucia mountains.

Mr. Milo S. Baker recently collected *Sedella pentandra* in the inner North Coast Range of California (near Lakeport, Lake County, May 1, 1938, *M. S. Baker 8957,* Herb. Univ. Calif.; Herb. Calif. Acad. Sci.), and sent me fresh plants for study. Except that branching is somewhat more common, the North Coast Range plants show no variation from the South Coast Range plants. The habitats involved are essentially similar.

THE STATUS OF THE GENUS SEDELLA BRITTON AND ROSE

Botanical opinion continues to vary as to the generic validity of *Sedella.* In the most recent treatment of *Sedum, Sedella* is included in *Sedum* as the section *Sedella* Berger (Fröderström, H., Acta Horti Gotoburgensis 10, append.: 80. 1935). *Sedella Congdoni,* reduced again to varietal status, is given the new combination, *Sedum pumilum* var. *Congdoni* (Eastw.) Fröderström. Britton and Rose (North American Flora 22: 7–74. 1905) recognize at least nine segregates of *Sedum* as genera, among them *Sedella,* but Fröderström, considering floral structure of predominant importance, presents an even more inclusive view of *Sedum* than does Berger in Die Natürlichen Pflanzenfamilien (ed. 2, 18A: 436–462. 1930).

Sedella has far more claim to generic distinction than many of the segregates of *Sedum,* but if the flower is the sole criterion used to determine generic boundaries between *Sedum* and its allies, many of the morphological features which combine to form an easily recognized unit of *Sedella* must be disregarded. When all available morphological evidence is evaluated with genetical, geographical and other data, however, *Sedella* appears to represent a small, distinct, natural genus of plants. It seems well, therefore, to review with greater detail than has been done, the morphological bases upon which the genus *Sedella* rests.

The always single, basally attached, erect seeds of *Sedella* form the chief technical basis for separating the genus from *Sedum*. This criterion distinguishes *Sedella* whether *Sedum* is viewed broadly or is divided into some or all of its numerous segregates. In *Sedum* and its other allies, the seeds are several to many and horizontal, with the one exception of *Telmissa*, a monotypic genus (or section) intermediate between *Sedum* and *Tillaea* and native to Asia Minor; in *Telmissa* the seeds are single and pendant.

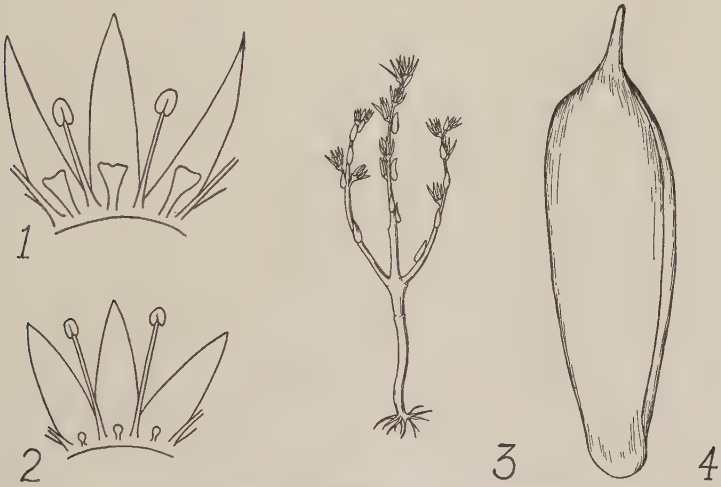

Fig. 1. *Sedella leiocarpa: 1,* portion of corolla showing attachment of stamens and nectaries, ×7; *2, S. pentandra,* same, ×7; *3, S. leiocarpa,* habit, ×0.7; *4, S. leiocarpa,* follicle, ×21.

In all four species of *Sedella,* the nectaries, which probably represent staminodia, are attached to the slightly sympetalous corolla opposite the carpels (see text figs. 1, 2). They apparently correspond to the so-called receptacle scales or hypogynous scales commonly regarded in the Crassulaceae as appendages of the carpels. Rendle (Class. Fl. Pl. vol. 2, 315. 1935) speaks of the fleshy habit and "the nectar-secreting appendages of the carpels" as the two most distinctive characteristics of the Crassulaceae. Evidence is lacking as to whether or not the epipetalous insertion of the nectaries is peculiar to *Sedella,* but references imply that receptacular attachment is the common mode of insertion in *Sedum* and in the Crassulaceae as a whole.

The strictly annual habit of *Sedella* forms a point of contrast with the typically perennial nature of *Sedum* and related groups. In addition, there is a complex of minor morphological characteristics which assists in knitting the species of *Sedella* into a closely bound biological unit. Familiarity with the living plants in their native environment is necessary to appreciate this complex fully; although it is difficult to select and describe individual characteristics, the following stand out: the diminutive stature; the small, disc shaped root system; the reddish stems with few to many erect or spreading branches; the caducous, gibbous leaves, opposite below and alternate above; the bracts which persist through the flowering stage; the small, pentamerous, sessile or subsessile flowers; the fleshy hypanthium; the minute, triangular calyx teeth; the persistent, slightly sympetalous, yellowish corolla with lanceolate or ovate-lanceolate lobes; the five to ten epipetalous, yellow-anthered stamens; and the distinct, clavate carpels.

In geographic distribution and in ecological requirements, as well as in morphological features, the genus *Sedella* forms a distinguishable unit. The four species are all endemic to the foothills and adjacent plains of central California, and their very similar and restricted habitats are not shared by other Californian genera of the Crassulaceae.

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October 16, 1938.

PRISCILLA AVERY

Priscilla Avery was born in Redlands, California, on June 12, 1899. One of five children, she was brought up in a cultural and intellectual atmosphere; her father, Lewis B. Avery, is a well known educator, a sister, a talented musician, and a brother, a noted inventor. Always distinguished in her academic work, Miss Avery held a Levi Strauss scholarship as an undergraduate at the University of California; she was elected to Phi Beta Kappa in her junior year, and at her graduation in 1926 she received highest honors in the College of Agriculture. She was a member of Sigma Xi and Phi Sigma science honor societies, also of the American Association for the Advancement of Science and the California Botanical Society.

As a graduate student, she carried on research in the field of genetics at the University of California, receiving the degree of Doctor of Philosophy in May, 1930. She was a teaching fellow in zoology and an assistant in the Division of Genetics during the academic year, 1927–1928. From 1928 to 1934 she held the position of preparator in the Department of Botany, and from 1934 until her death on December 29, 1939, she was cytologist for the University of California Botanical Garden.

While associated with the Division of Genetics of the College of Agriculture, her work was concerned with interspecific hybrids in *Crepis* with special reference to chromosome morphology. Later, after taking up her position with the Department of Botany and finally with the Botanical Garden she worked almost exclusively with *Nicotiana*. As a microtechnician in her own field she was unsurpassed. She published significant contributions on chromosome morphology and behavior in inheritance in *Nicotiana tabacum*. Her last paper, published with Dr. Thomas Harper Goodspeed, was a comprehensive survey of the trisomic types expected and discovered in *Nicotiana sylvestris*. It represents the results of an immense amount of work done on hybrids and crosses through a period of years. Dr. Avery's experience and knowledge of the subject enabled her to coordinate all of these data. In no other species except *Datura stramonium* has a complete set of primary trisomic types been established.

During the last twelve years of her life while she was concerned especially with work on *Nicotiana*, she gained a comprehensive knowledge of specific and cytogenetic relationships in the genus and was ever ready with helpful suggestions for her associates. She came to know many scientists in related fields and made a deep impression of scientific honesty and analytical keenness on all with whom she came in contact.

PRISCILLA AVERY

Her life-long struggle for health is an inspiring story of a successful attempt to overcome what would seem to be insurmountable difficulties. Her strict adherence to a schedule is evidence of the perseverance, spirit of determination and tremendous energy which enabled her to overcome the odds against her and to lead a normal life. In the death of Dr. Avery, plant scientists, especially those in cytology and genetics, lost one of their most able workers and sincere friends. She died after a year's illness which she faced courageously. Her many friends will always remember her, not only as a scientist, but as a generous and sympathetic person,—one whose first thought was for the comfort and happiness of others.—MARION CAVE.

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PINUS TORREYANA IN CULTIVATION

Albert Wilson

Throughout the garden districts of San Francisco peninsula are grown plants of unusual quality, many of which are exotics introduced into California from various countries of the world. However, among our native plants there are a few which, because of their limited natural distribution, have been claimed as garden subjects. Among the latter is *Pinus Torreyana,* the Torrey pine.

Pinus Torreyana is native only on Santa Rosa Island and on the southern California coast twenty-two miles north of San Diego. In these two areas the trees are small with widely spreading branches forming symmetrical crowns, but under cultivation they adopt a habit distinctly foreign to that of their native state. One of the finest cultivated specimens in the state of California is a tree fifty years old. It is growing in excellent garden soil in an open area favored by sun all day and is situated about one hundred feet from a characteristic Californian creek, namely one which has running water but a few months of the year. The tree is seventy-five feet tall and the total spread of the branch system is about one hundred five feet. The main branches are displayed in a tier-like arrangement with the lowest tier composed of four major branches. The largest of these is thirty-three inches in

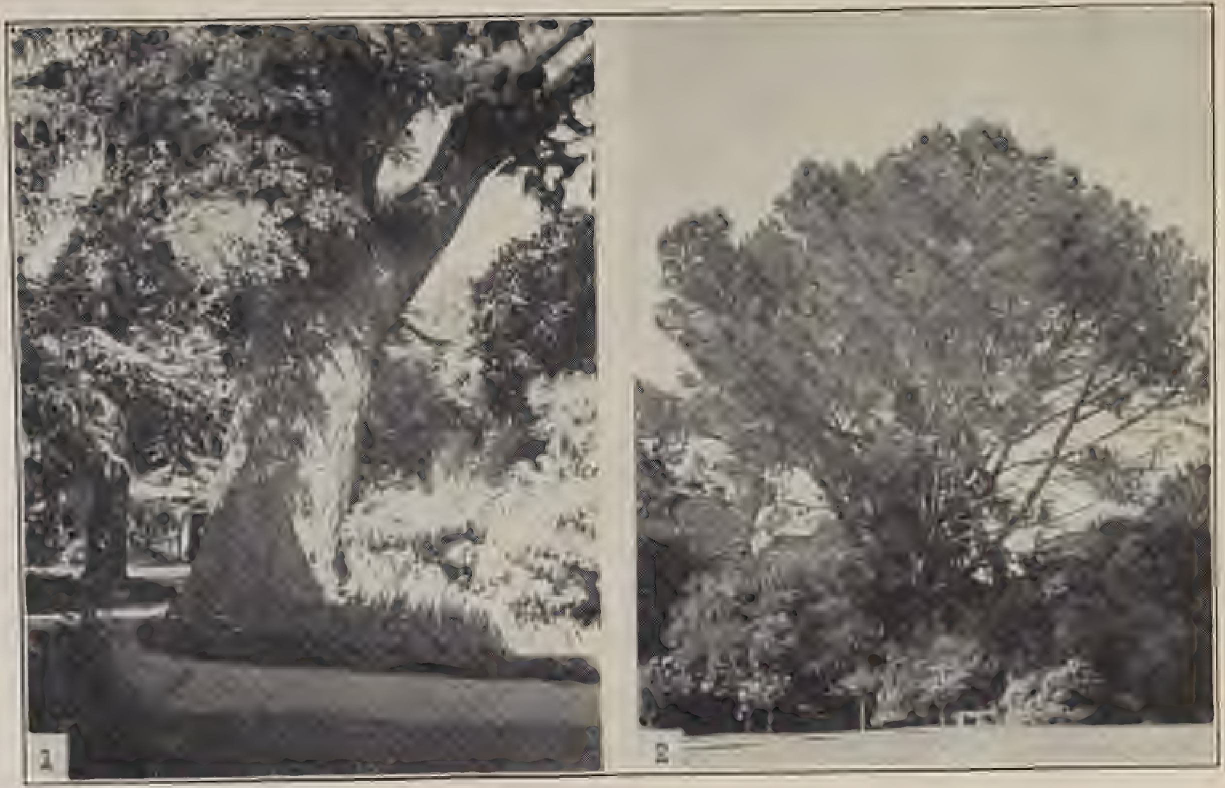

Plate 18. *Pinus Torreyana.* Fig. 1 Trunk and lowest tier of branches. Fig. 2 Habit and branching of crown.

diameter at its junction with the main trunk of the tree. Above the lowest tier of branches is a second tier composed of three large branches. All of the branches extend upward, spreading in the broad, open habit characteristic of the Torrey pine. Very few cones are to be observed on the tree. The trunk is like that of a massive oak. The diameter, breast-high, is five feet six inches, at ground level, eight feet; fourteen feet above the ground the lowest tier of branches diverges from the trunk (pl. 18, fig. 1).

This magnificent specimen is in the garden of the W. P. Fuller, Jr., estate at 245 El Cerrito, Hillsborough, San Mateo County, California. It is without doubt the finest specimen in the gardens of our bay district.

At Carpinteria, Santa Barbara County, there is another fine specimen which measures one hundred feet in height, more than one hundred feet in the diameter of the crown, and nearly five feet in diameter, breast-high.

Happy Hours, Menlo Park,
California, August, 1939.

SIX THISTLES RECENTLY INTRODUCED INTO TEXAS

V. L. Cory[1]

Centaurea melitensis L. So far as known, the star thistle was first collected in Texas in Bexar County in 1934 by Mr. H. B. Parks. The writer first saw and collected it along the highway in Kerr County, five miles west of Comfort on May 24, 1935. Since then this species has spread rapidly to the south, west and north, apparently along highways only, as far as two hundred miles from the Kerr County locality. It is now abundant along the sides of many of the roads of the Edwards Plateau. Mr. Parks writes that it is quite abundant on roadsides as far east as central Gonzales County. This thistle is a native of Europe, but has become established in the Pacific States. It is reported also from Georgia and Alabama to Massachusetts, Missouri and westward.

Centaurea picris Pall. (*C. repens* L.) On June 2, 1937, the writer received from Superintendent J. J. Bayles of Texas Substation No. 9 at Balmorhea, Reeves County, good specimens of this species, commonly known as Turkestan thistle, with the statements that this plant had become introduced into the irrigated alfalfa fields of that section, and that it might prove to be a troublesome weed. This Asiatic species is established locally in California, and has also been discovered in alfalfa fields in Montana.

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[1] Range Botanist, Texas Substation No. 14, Sonora, Texas.

Silybum marianum (L.) Gaertn. A strange thistle having large mottled and prickly leaves was noted on a ranch in southeastern Sutton County, March 16, 1938. The locality was revisited in August of the same year, at which time the plants had matured and died. A few achenes were salvaged, and the species was determined as *Silybum marianum* (L.) Gaertn., lady's thistle. Since its introduction locally two or three years ago, this species has increased its area until it occupies a small field located in a large pasture, but has spread only a few feet into the surrounding pasture land. Apparently, therefore, it will not infest the range, but, as it is not a forage plant, should be eradicated, or prevented from spreading to other cultivated fields. Where controlled, this thistle may be a desirable ornamental plant. This species is a native of southern Europe, and has been introduced locally from Alabama to Ontario, and westward to the Pacific Coast. This seems to be the first report of its occurrence in Texas.

On May 18, 1939, two other introduced thistles were collected on this same ranch, both growing with *Silybum marianum,* but more abundantly in a similar small field, half a mile east of the first, located in the same large pasture. These thistles are supposed to have been introduced through a shipment of hay coming from California.

Carduus pycnocephalus L. The first of the two species, slender thistle, is a native of southern Europe and central Asia, and has been found growing at localities in New York, New Jersey, and Pennsylvania, always as a mere casual of industrial areas. This thistle has relatively small heads which are clustered at the ends of winged branches.

Carduus nutans L. Musk thistle, the second species is characterized by large solitary heads of purple flowers which are markedly fragrant. Like *C. pycnocephalus,* this species also is a native of Eurasia. It has been found in this country in waste places and about seaports from Pennsylvania to New Brunswick. This seems to be the first report of its occurrence in Texas.

Onopordum Acanthium L. A dense infestation of a rather large thistle, mostly six feet or more high, uniformly white-tomentose with stems and branches provided with spiny-margined wings, was visited in Tarrant County, May 21, 1939. This species, cotton thistle, is a native of Eurasia, but has been introduced locally from Alabama to Michigan, New Jersey, Ontario and New Brunswick. This report appears to be the first of its occurrence in Texas. This plant has spread from the west side of the stock yards at Fort Worth to a distance of about two miles, and gives evidence of being adapted to the soils and climate of that vicinity. If it proves to have a tendency to occupy other than waste land it should be eradicated at the first opportunity.

Specimens of all species discussed herein are deposited in the Tracy Herbarium at the Agricultural and Mechanical College of Texas, and at Gray Herbarium, Harvard University.

Texas Agricultural Experiment Station,
Agricultural and Mechanical College of Texas,
College Station, August 30, 1939.

REVIEW

Liverworts of southern Michigan. By William C. Steere. Cranbrook Institute of Science, Bulletin no. 17. Pp. 1–97, pls. I–XXII and frontispiece. Bloomfield Hills, Michigan. 1940. Waterproof cloth, $1.00; paper, $0.50.

Dr. Steere has written this book for beginners. There are eight or nine pages devoted to the structure and reproduction of liverworts, where they grow, how to gather and preserve them, how to identify them. The language is simple so that anyone with little knowledge of botany may understand. A glossary of three dozen necessary scientific terms used in describing the plants aids in simplification. There is a key to the genera and species which occur in southern Michigan; also short descriptions of genera and species. Most useful of all, perhaps, are twenty-three pages of photographs and drawings.

The book will be of great help to anyone beginning the identification of liverworts, whether of Michigan or not, especially on account of the excellent illustrations.—T. C. Frye, Department of Botany, University of Washington, Seattle.

NOTES AND NEWS

Nutlets of Amsinckia intermedia Toxic to Swine, Horses and Cattle. (Scientific paper No. 428, Agricultural Experiment Station, State College of Washington). The toxicity of the nutlets of *Amsinckia intermedia* Fisch. & Mey. is attested by the fact that nine pigs, three horses and one of three calves, fed wheat screenings containing them, developed hepatic cirrhosis. The parenchymal cells of the liver were destroyed and replaced by connective tissue. In swine and cattle the condition is locally known as "hard liver" disease. In horses, it is known as "walking disease" because of the tendency of horses with hepatic cirrhosis to wander aimlessly. Only in certain semi-arid regions of Washington, Oregon and Idaho, where *Amsinckia intermedia* grows abundantly in the grain fields, has the condition been recognized clinically. In certain limited regions the raising of swine and horses has been almost abandoned. It is probable that sublethal poisoning may be much more widespread, occurring in those areas where the species is only moderately abundant. Because of its irritant nature, animals do not graze the plant but readily eat the seed which is harvested with the grain and which has a pleasant nut-like flavor. *Amsinckia intermedia* has not previously been reported as toxic.—ERNEST C. MCCULLOCH, State College of Washington, Pullman, Washington.

On January 16, 1940, once again the Velero III, 198-foot, twin-diesel cruiser of the University of Southern California, moved out from the dock at San Pedro and another Allan Hancock Scientific Expedition was under way. The objective of the cruise was to continue a program of collecting in the Gulf of California which had been visited previously by Velero III on two occasions. The expeditions of the Velero III are conducted under the leadership of Captain G. Allan Hancock who has donated funds for the establishment of the Hancock Foundation for Biological Research at the University of Southern California. The scientific party consisted of eight members: seven zoologists from the University of Southern California, each with his special line of investigation, marine invertebrates, fishes, birds, mammals, parasites; and as botanist Mr. E. Yale Dawson of the University of California, Berkeley.

Intensive collecting began with dredging stations on the Gordas Banks near San Jose del Cabo, Baja California, and was continued into the Gulf to Tiburon Island, Puerto Refugio, Consag Rock, and as far north as Rocky Point, Sonora. On the return to the Cape, stations were made at numerous points including San Esteban Island, San Carlos Bay, Agua Verde Bay, and Espiritu Santo Island. In all, five and one-half weeks were spent to great advantage. Mr. Dawson's botanical collections consist of six hundred flowering plant specimens, including a considerable number of rare cacti of the Gulf-islands, and about five thousand specimens of marine algae of some four hundred species. The work of handling and the determination of the collection of algae will be done at the University of California under the direction of Dr. W. A. Setchell.

Word has been received from Professor Milo S. Baker that the biennial Wild Flower Show will be held in the Science Building, Santa Rosa Junior College on Sunday afternoon, May 5, 1940. Because of the favorable season, Mr. Baker expects the exhibit this year to be more comprehensive and more interesting than usual.

The following communication has been received from Dr. W. L. Jepson: "A reserve stock of sheets of Jepson's 'Manual of the Flowering Plants of California' has been specially bound in heavy tarboard with reinforced tapes and waterproof buckram, making it suitable for use in the field. It is now available. Associated Students' Store, Berkeley, Calif. ($5.00)."

The California Forest and Range Experiment Station has announced the publication of twenty quadrangles of the vegetation type map of California. These may be purchased at one dollar each from the University of California Press at Berkeley. Details of the type map project are discussed in Madroño, volume three, page 140, 1935.

Recent articles in the field of taxonomy are: "a revision of the North American species of Descurainia," by Leroy E. Detling (Am. Midland Nat. 22: 481–520. 6 maps. 1939); "a revision of the genus Brodiaea," by Robert F. Hoover (*op. cit.* 551–574); "some realignments in the genus Nemacladus," by Rogers McVaugh (*op. cit.* 521–550. 3 pls.); "Mexican involucrate Trifoliums," by Alice Vaughn (*op. cit.* 575–579. 1 fig.). The following recently published articles pertain to the flora of Alaska or northeastern Asia:" plants used by the Eskimo of the northern Bering Sea and arctic regions of Alaska," by J. P. Anderson (Am. Jour. Bot. 26. 714–716. 1939); "a fourth expedition to Glacier Bay, Alaska" (Ecology 20: 130–155. 1939), "additions to the flora of the Glacier Bay monument, Alaska, 1935–1936," by W. S. Cooper (Bull. Torr. Bot. Club 66: 433–456. 1939); "flora of Little Diomede Island in Bering Strait" (Trans. Roy. Soc. Canada ser. 3, 32: 21–28. 1938), "contributions to the flora of Alaska" (Rhodora 41: 141–183, 262–301. 1939), by A. E. Porsild.—E. Crum.

As a memorial to Dr. Priscilla Avery a loan fund has been established to be made available to graduate students of the University of California, Berkeley, with preference to be given to students of botany, genetics and other biological sciences. This fund will be administered by the dean of the undergraduates.

PROCEEDINGS OF THE CALIFORNIA BOTANICAL SOCIETY

January 18, 1940. Meeting, 2093 Life Sciences Building, University of California, Berkeley, at 7:45 p. m. The President, Professor H. E. McMinn, occupied the chair. The annual report of the Treasurer was read and approved. Mr. Palmer Stockwell, chairman of the Program Committee, announced a tentative list of meetings for the semester. The Secretary read the list of candidates for office nominated at the previous meeting, and was authorized to cast a unanimous vote for the slate as nominated. President McMinn installed the officers, and then relinquished the chair to Dr. Wiggins, President-elect. Mr. M. W. Talbot, Senior Forest Ecologist of the California Range and Forestry Experiment Station, Berkeley, spoke on, "Fluctuations in the Plant Population of Western Ranges." The lecture was illustrated with slides. Mr. H. C. Trumble, of Waite Agricultural Research Institute, University of Adelaide, South Australia, who was a guest of the evening, was introduced to the Society by President Wiggins.

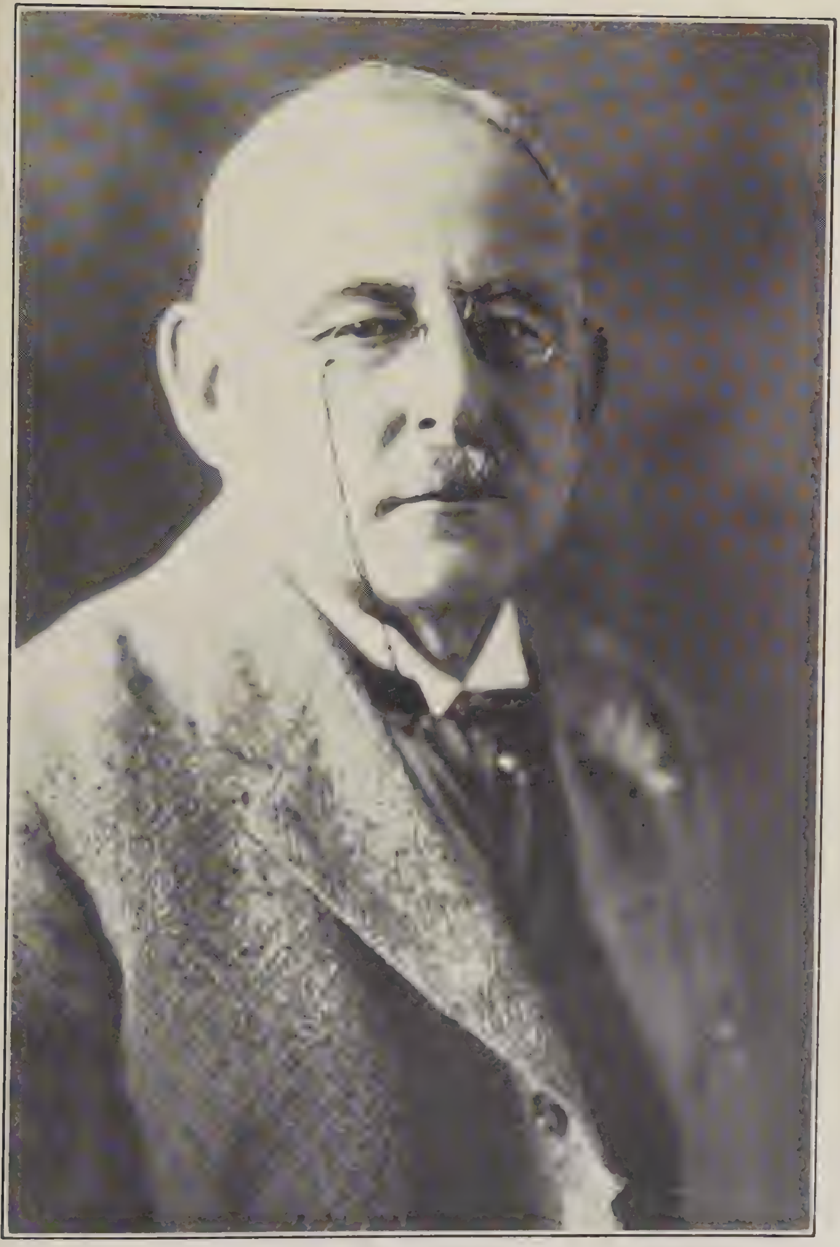

Plate 19. Douglas Houghton Campbell, speaker at the annual dinner of the California Botanical Society (see page 205).

February 15, 1940. Meeting, 2093 Life Sciences Building, University of California, Berkeley, at 7: 45 p. m. The President, Dr. Ira L. Wiggins, occupied the chair. Dr. Alden S. Crafts, Associate Professor of Botany and Associate Botanist in the Experiment Station, University of California, Davis, spoke on, "New Developments in the Physiology of Food Movements in Plants."

March 2, 1940. The annual dinner of the California Botanical Society was held at Mary Morse Hall, Mills College, on Saturday evening, at 6: 30 o'clock. Eighty-three members and their friends were present for the banquet. Dr. Ira L. Wiggins, President, acted as toastmaster, and read letters from Professor Louis F. Henderson and Professor Milo S. Baker. An attractive exhibition of liverworts, mosses and flowering plants was on display in a small room adjoining the lounge.

Dr. Douglas Houghton Campbell, Professor of Botany, Emeritus, of Stanford University, was the speaker of the evening. The subject of his address was "Fifty Years of Botany." He chose for especial emphasis the debt of American workers in plant morphology and plant physiology to the contributions of Sachs, Hofmeister, Strasburger, DeVries and others.

The very enjoyable and successful evening was in charge of the program committee: Mr. Palmer Stockwell, chairman; Dr. Adriance S. Foster, and Dr. G. Ledyard Stebbins, Jr., with valuable assistance from Professor H. E. McMinn and Dr. Lucile R. Mason.—L. Constance, Secretary.

MEMBERS OF THE CALIFORNIA BOTANICAL SOCIETY AND SUBSCRIBERS TO MADROÑO, APRIL, 1940

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Academy of Natural Sciences of Philadelphia
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Alexander, Miss Annie M.
Allen, Dr. Winifred E.
Anderson, Dr. Edgar
Angst, Dr. Laura
Applegate, Mr. Elmer
Arnold Arboretum, Harvard University
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Austin, Mr. Lloyd
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Baer, Mr. Herman L.
Bailey, Dr. L. H.
Bailey, Mrs. Virginia
Baird, Mrs. Dudley
Baker, Prof. Milo S.
Baldwin, Dr. J. T., Jr.
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Barbour, Mr. F. F.
Bauer, Dr. Harry L.
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Beinke, Mr. Sidney C.
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Bliss, Mrs. Robert W.
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Botanische Staatsanstalten, Munich

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Boyd, Miss Louise A.
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British Museum of Natural History, London
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Brooks, Dr. Reid M.
Bullard, Mrs. Sellar
Bunting, Miss Leatha
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California Garden Clubs, Inc., Pasadena
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Cannon, Dr. William A.
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Carruth, Mr. William W.
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Chandler, Dr. William H.
Chaney, Dr. Ralph W.
Chapman, Miss Clara
Chase, Mr. Harold S.
Chase, Miss Pearl
Christ, Mr. J. H.
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Ramaley, Dr. Francis
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Yule, Mr. W. H.